

ONLINE SUPPLEMENTARY MATERIAL

American Society for Enhanced Recover (ASER) and Perioperative Quality Initiative (POQI) Joint Consensus Statement on Postoperative Delirium Prevention

Christopher G. Hughes, MD, MS; Christina S. Boncyk, MD; Deborah J. Culley, MD; Lee A. Fleisher, MD; Jacqueline M. Leung, MD, MPH; David L. McDonagh, MD; Tong J. Gan, MD, MHS, FRCA; Matthew D. McEvoy, MD; Timothy E. Miller, MB, ChB, FRCA; for the Perioperative Quality Initiative (POQI) 6 Workgroup

Table of Contents

- A. POQI Process Details
- B. Supplemental Table 1. GRADE System
- C. Systematic Search for Studies on Postoperative Delirium
- D. Supplemental Figure 1. PRISMA Flowchart
- E. Supplemental Table 2. Consensus Recommendation Voting
- F. Supplemental Table 3. Delirium Assessment Tools
- G. Dissent Statement Concerning Processed EEG

A. POQI Process Details

The POQI process is based on an established modified Delphi process used in the Acute Dialysis Quality Initiative (ADQI) conferences and includes the following iterative steps before (steps 1 and 2) and during (step 3) the conference: 1) building consensus around the most important questions related to the topic, 2) a literature review of the topic raised by each question, 3) sequential steps of content development and refinement until agreement is achieved and a consensus document is produced. This final step of content development and refinement involves a modified Delphi process of alternating breakout and plenary sessions. In the breakout sessions, work groups address the issues in their assigned topic area and formulate consensus statements and recommendations for current practice and for future research. The GRADE process is used to rate the strength of recommendations and the level of evidence in the consensus statements (Online Supplement Table 1).³¹⁻⁴¹ In the plenary sessions, the findings and deliberations of each work group are presented, debated, and refined. Consensus on some statements and recommendations may be achieved in the first plenary session. Other statements and recommendations require further refinement by the work groups before re-presentation to the plenary group in the next cycle. In the final session of the conference, plenary group members vote to signal either formal agreement with the final statements/recommendations or any disagreement. In the latter case, the dissenting comment and the group member who made the comment are recorded.

B. Supplemental Table 1. GRADE system used for POQI-6 Consensus Statement Ratings*

Quality of Evidence	
A	Further research is very unlikely to change our confidence in the estimate of effect
B	Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate
C	Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate
D	Any estimate of effect is very uncertain
Strength of Recommendation**	
Strong	Concerning an intervention or action, most patients would want it; most clinicians would recommend it; it can be adopted as policy in most situations
Weak	Concerning an intervention or action, most people would want it, but many would not; clinicians would recognize a that different choices will be appropriate for different patients; policy-making will require substantial debate and involvement of many stakeholders.

*from Guyatt GH, et al. BMJ, 2008;336:1049-1051.

**took into account 4 key components: consequences, evidence, values/preferences, and cost.

C. Systematic Search for Studies on Postoperative Delirium

We complied with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines in conducting a systematic search of available literature pertaining to postoperative delirium. The literature on postoperative delirium is vast; therefore, only studies that evaluated risk factors, screening methods, assessment tools, and interventions aimed at reducing delirium risk were evaluated. For content to be included in the paper, we searched PubMed from 1966 to October 2018 using relevant search terms (MeSH Terms, All Fields, and similar wording for each included term) with the filters of ‘human’, ‘age 18+’, and ‘published in English’ selected. Examples of search terms include anesthesia, surgery, postoperative, perioperative, and delirium. Results were focused further for each question through search of keywords including etiology, causality, risk, risk factors, detection, screening, assessment, prevent, reduce, decrease, critical illness, ICU. Example search results are provided below. This literature search was supplemented by reading the relevant references of the articles identified and by articles previously known to the group. We excluded case reports, commentaries, letters, editorials, review articles, and articles focusing on treatment of delirium in the search. Results were reviewed at the title and abstract level for inclusion. Included articles relevant to the individual questions and recommendations were then further reviewed to determine the GRADE level of evidence for each recommendation.

Search Statement #	Terms	Concepts	Results
1	Adult	"adult"[MeSH Terms] OR "adult"[All Fields]	7,089,845
2	Anesthesia OR Surgery	("anaesthesia"[All Fields] OR "anesthesia"[MeSH Terms] OR "anesthesia"[All Fields]) OR ("surgery"[Subheading] OR "surgery"[All Fields] OR "surgical procedures, operative"[MeSH Terms] OR ("surgical"[All Fields] AND "procedures"[All Fields] AND "operative"[All Fields]) OR "operative surgical procedures"[All Fields] OR "surgery"[All Fields] OR "general surgery"[MeSH Terms] OR ("general"[All Fields] AND "surgery"[All Fields]) OR "general surgery"[All Fields])	4,520,344
3	Postoperative OR Perioperative	("postoperative period"[MeSH Terms] OR ("postoperative"[All Fields] AND "period"[All Fields]) OR "postoperative period"[All Fields] OR "postoperative"[All Fields]) OR Perioperative[All Fields]	781,067
4	#1 AND #2 AND #3	("adult"[MeSH Terms] OR "adult"[All Fields]) AND (("anaesthesia"[All Fields] OR "anesthesia"[MeSH Terms] OR "anesthesia"[All Fields]) OR ("surgery"[Subheading] OR "surgery"[All Fields] OR "surgical procedures, operative"[MeSH Terms] OR ("surgical"[All Fields] AND "procedures"[All Fields] AND "operative"[All Fields]) OR "operative surgical procedures"[All Fields] OR "surgery"[All Fields] OR "general surgery"[MeSH Terms]	439,966

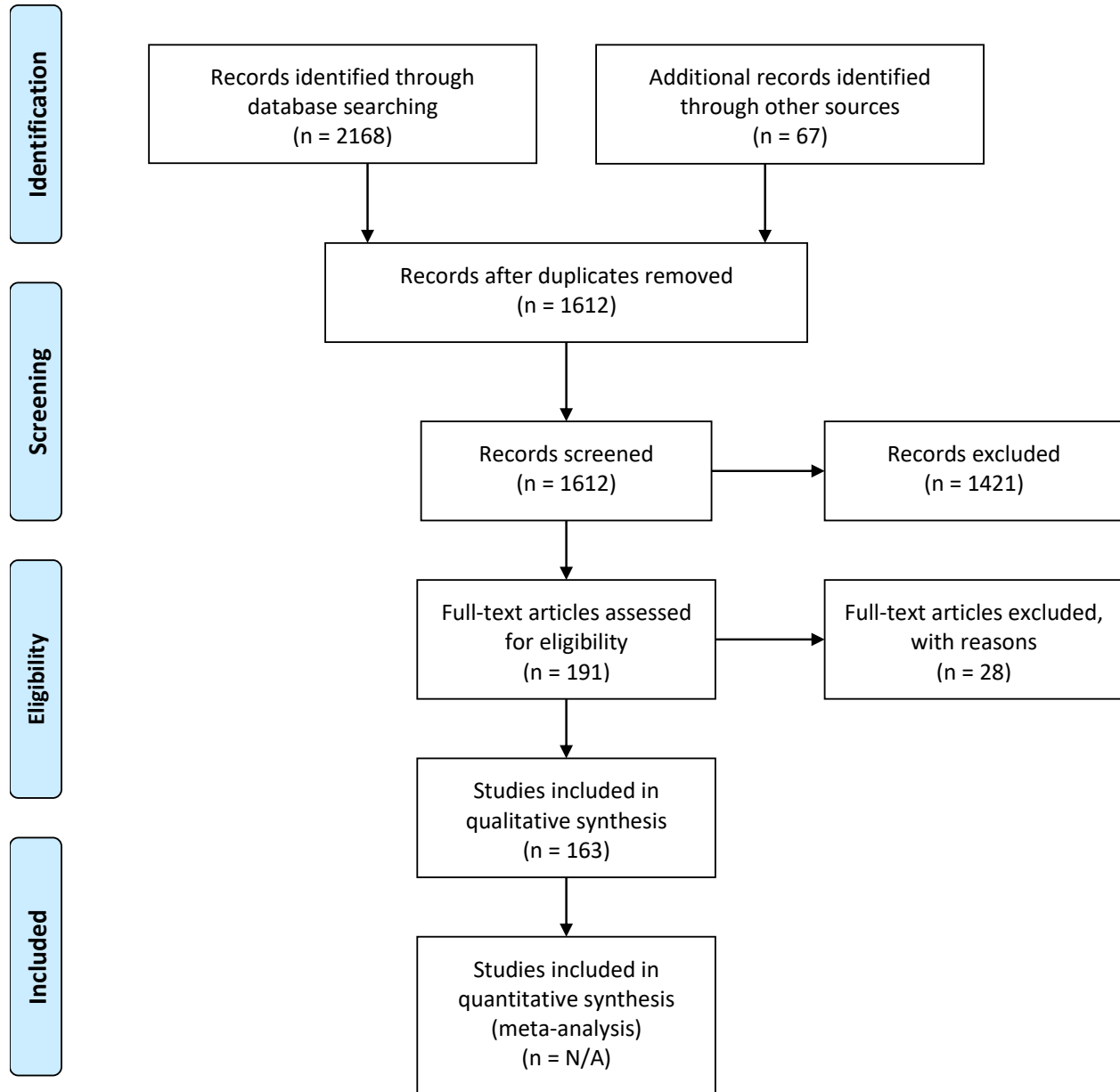
		OR ("general"[All Fields] AND "surgery"[All Fields]) OR "general surgery"[All Fields])) AND (("postoperative period"[MeSH Terms] OR ("postoperative"[All Fields] AND "period"[All Fields]) OR "postoperative period"[All Fields] OR "postoperative"[All Fields]) OR perioperative[All Fields])	
5	(#1 AND #2 AND #3) AND Delirium	("adult"[MeSH Terms] OR "adult"[All Fields]) AND ((("anaesthesia"[All Fields] OR "anesthesia"[MeSH Terms] OR "anesthesia"[All Fields]) OR ("surgery"[Subheading] OR "surgery"[All Fields] OR "surgical procedures, operative"[MeSH Terms] OR ("surgical"[All Fields] AND "procedures"[All Fields] AND "operative"[All Fields]) OR "operative surgical procedures"[All Fields] OR "surgery"[All Fields] OR "general surgery"[MeSH Terms] OR ("general"[All Fields] AND "surgery"[All Fields]) OR "general surgery"[All Fields])) AND (("postoperative period"[MeSH Terms] OR ("postoperative"[All Fields] AND "period"[All Fields]) OR "postoperative period"[All Fields] OR "postoperative"[All Fields]) OR perioperative[All Fields]) AND ("delirium"[MeSH Terms] OR "delirium"[All Fields])	1456
6	(#1 AND #2 OR #3) AND Delirium	("adult"[MeSH Terms] OR "adult"[All Fields]) AND (((("anaesthesia"[All Fields] OR "anesthesia"[MeSH Terms] OR "anesthesia"[All Fields]) OR ("surgery"[Subheading] OR "surgery"[All Fields] OR "surgical procedures, operative"[MeSH Terms] OR ("surgical"[All Fields] AND "procedures"[All Fields] AND "operative"[All Fields]) OR "operative surgical procedures"[All Fields] OR "surgery"[All Fields] OR "general surgery"[MeSH Terms] OR ("general"[All Fields] AND "surgery"[All Fields]) OR "general surgery"[All Fields])) OR ((("postoperative period"[MeSH Terms] OR ("postoperative"[All Fields] AND "period"[All Fields]) OR "postoperative period"[All Fields] OR "postoperative"[All Fields]) OR perioperative[All Fields])) AND ("delirium"[MeSH Terms] OR "delirium"[All Fields])	2235
7	#5 AND Detection OR Screening OR Assessment OR Tool	("adult"[MeSH Terms] OR "adult"[All Fields]) AND ((("anaesthesiology"[All Fields] OR "anesthesiology"[MeSH Terms] OR "anesthesiology"[All Fields]) OR ("surgery"[Subheading] OR "surgery"[All Fields] OR "surgical procedures, operative"[MeSH Terms] OR ("surgical"[All Fields] AND "procedures"[All Fields] AND "operative"[All Fields]) OR "operative surgical procedures"[All Fields] OR "surgery"[All Fields] OR "general surgery"[MeSH Terms] OR ("general"[All Fields] AND "surgery"[All Fields]) OR "general surgery"[All Fields])) AND (perioperative[All Fields] OR ("postoperative period"[MeSH Terms] OR ("postoperative"[All Fields] AND "period"[All Fields]) OR "postoperative period"[All Fields] OR "postoperative"[All Fields])) AND ("delirium"[MeSH Terms] OR "delirium"[All Fields]) AND (Detection[All Fields] OR	829

		("diagnosis"[Subheading] OR "diagnosis"[All Fields] OR "screening"[All Fields] OR "mass screening"[MeSH Terms] OR ("mass"[All Fields] AND "screening"[All Fields]) OR "mass screening"[All Fields] OR "screening"[All Fields] OR "early detection of cancer"[MeSH Terms] OR ("early"[All Fields] AND "detection"[All Fields] AND "cancer"[All Fields]) OR "early detection of cancer"[All Fields] OR ("Assessment"[Journal] OR "assessment"[All Fields]) OR Tool[All Fields])	
8	#6 AND Detection OR Screening OR Assessment OR Tool	("adult"[MeSH Terms] OR "adult"[All Fields]) AND (((("anaesthesiology"[All Fields] OR "anesthesiology"[MeSH Terms] OR "anesthesiology"[All Fields]) OR ("surgery"[Subheading] OR "surgery"[All Fields] OR "surgical procedures, operative"[MeSH Terms] OR ("surgical"[All Fields] AND "procedures"[All Fields] AND "operative"[All Fields]) OR "operative surgical procedures"[All Fields] OR "surgery"[All Fields] OR "general surgery"[MeSH Terms] OR ("general"[All Fields] AND "surgery"[All Fields]) OR "general surgery"[All Fields])) OR (perioperative[All Fields] OR ("postoperative period"[MeSH Terms] OR ("postoperative"[All Fields] AND "period"[All Fields]) OR "postoperative period"[All Fields] OR "postoperative"[All Fields]))) AND ("delirium"[MeSH Terms] OR "delirium"[All Fields]) AND (Detection[All Fields] OR ("diagnosis"[Subheading] OR "diagnosis"[All Fields] OR "screening"[All Fields] OR "mass screening"[MeSH Terms] OR ("mass"[All Fields] AND "screening"[All Fields]) OR "mass screening"[All Fields] OR "screening"[All Fields] OR "early detection of cancer"[MeSH Terms] OR ("early"[All Fields] AND "detection"[All Fields] AND "cancer"[All Fields]) OR "early detection of cancer"[All Fields] OR ("Assessment"[Journal] OR "assessment"[All Fields]) OR Tool[All Fields])	1307

Search Statement #	Terms	Concepts	Results
1	Adult	Search (adult) OR adult[MeSH Terms]	7097073
2	Anesthesia OR Surgery	Search (((((anesthesia) OR anaesthesia) OR anesthesia[MeSH Terms]) OR anaesthesia[MeSH Terms]) OR surgery) OR surgery[MeSH Terms]	4525014
3	Postoperative OR ICU	Search (((((((postoperative) OR postoperative[MeSH Terms]) OR critical illness) OR critical illness[MeSH Terms]) OR intensive care unit) OR intensive care unit[MeSH Terms]) OR ICU) OR ICU[MeSH Terms]	911347

4	#1 AND #2 AND #3	Search (((((((((((postoperative) OR postoperative[MeSH Terms]) OR critical illness) OR critical illness[MeSH Terms]) OR intensive care unit) OR intensive care unit[MeSH Terms]) OR ICU) OR ICU[MeSH Terms])) AND (((((((((((anesthesia) OR anaesthesia) OR anesthesia[MeSH Terms]) OR anaesthesia[MeSH Terms]) OR surgery) OR surgery[MeSH Terms])) AND ((adult) OR adult[MeSH Terms]))	444034
5	(#1 AND #2 AND #3) AND Delirium	Search (((((((((((((((postoperative) OR postoperative[MeSH Terms]) OR critical illness) OR critical illness[MeSH Terms]) OR intensive care unit) OR intensive care unit[MeSH Terms]) OR ICU) OR ICU[MeSH Terms])) AND (((((((((((anesthesia) OR anaesthesia) OR anesthesia[MeSH Terms]) OR anaesthesia[MeSH Terms]) OR surgery) OR surgery[MeSH Terms])) AND ((adult) OR adult[MeSH Terms])))) AND delirium) OR delirium[MeSH Terms]	8613
6	(#1 AND #2 OR #3) AND Delirium AND Prevention	Search (((((((((((((((postoperative) OR postoperative[MeSH Terms]) OR critical illness) OR critical illness[MeSH Terms]) OR intensive care unit) OR intensive care unit[MeSH Terms]) OR ICU) OR ICU[MeSH Terms])) AND (((((((((((anesthesia) OR anaesthesia) OR anesthesia[MeSH Terms]) OR anaesthesia[MeSH Terms]) OR surgery) OR surgery[MeSH Terms])) AND ((adult) OR adult[MeSH Terms])))) AND delirium) OR delirium[MeSH Terms])) AND prevention	1503
7	(#1 AND #2 OR #3) AND Delirium AND Decrease	Search (((((((((((((((postoperative) OR postoperative[MeSH Terms]) OR critical illness) OR critical illness[MeSH Terms]) OR intensive care unit) OR intensive care unit[MeSH Terms]) OR ICU) OR ICU[MeSH Terms])) AND (((((((((((anesthesia) OR anaesthesia) OR anesthesia[MeSH Terms]) OR anaesthesia[MeSH Terms]) OR surgery) OR surgery[MeSH Terms])) AND ((adult) OR adult[MeSH Terms])))) AND delirium) OR delirium[MeSH Terms])) AND decrease	240
8	(#1 AND #2 OR #3) AND Delirium AND Reduction	Search (((((((((((((((postoperative) OR postoperative[MeSH Terms]) OR critical illness) OR critical illness[MeSH Terms]) OR intensive care unit) OR intensive care unit[MeSH Terms]) OR ICU) OR ICU[MeSH Terms])) AND (((((((((((anesthesia) OR anaesthesia) OR anesthesia[MeSH Terms]) OR anaesthesia[MeSH Terms]) OR surgery) OR surgery[MeSH Terms])) AND ((adult) OR adult[MeSH Terms])))) AND delirium) OR delirium[MeSH Terms])) AND reduction	225
9	#6 AND #7 and #8	Search (((((((((((((((((((postoperative) OR postoperative[MeSH Terms]) OR critical illness) OR critical illness[MeSH Terms]) OR intensive care unit) OR intensive care unit[MeSH Terms]) OR ICU) OR ICU[MeSH Terms])) AND (((((((((((anesthesia) OR anaesthesia) OR anesthesia[MeSH Terms]) OR anaesthesia[MeSH Terms]) OR surgery) OR surgery[MeSH Terms])) AND ((adult) OR adult[MeSH Terms])))) AND delirium) OR delirium[MeSH Terms])) AND prevention)) OR (((((((((((((((((((postoperative) OR postoperative[MeSH Terms]) OR critical illness) OR critical illness[MeSH Terms]) OR intensive care unit) OR intensive care unit[MeSH Terms]) OR ICU) OR ICU[MeSH Terms])) AND (((((((((((anesthesia) OR anaesthesia) OR anesthesia[MeSH Terms]) OR anaesthesia[MeSH Terms]) OR surgery) OR surgery[MeSH Terms])) AND ((adult) OR adult[MeSH Terms])))) AND delirium) OR delirium[MeSH Terms])) AND decrease)) OR (((((((((((((((((((postoperative) OR postoperative[MeSH Terms]) OR critical illness) OR critical illness[MeSH Terms]) OR intensive care unit) OR intensive care unit[MeSH Terms]) OR ICU) OR ICU[MeSH Terms])) AND (((((((((((anesthesia) OR anaesthesia) OR anesthesia[MeSH Terms]) OR anaesthesia[MeSH Terms]) OR surgery) OR surgery[MeSH Terms])) AND ((adult) OR adult[MeSH Terms])))) AND delirium) OR delirium[MeSH Terms])) AND reduction)	1747

D. Supplemental Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) Flowchart



E. Supplemental Table 2. Consensus Recommendation Voting

Statement	Strength	LOE	For	Against	Comment
We recommend hospitals and health systems develop processes to reduce the incidence and consequences of postoperative delirium through an iterative multidisciplinary quality improvement process.	Strong	D	21		
We recommend that health care providers identify surgical patients at high risk for postoperative delirium	Strong	C	21		
We recommend that surgical patients identified as high risk for postoperative delirium be informed of the risk.	Weak	D	21		
We recommend hospital and health systems develop a process to assess for postoperative delirium in older high-risk patients	Strong	C	21		
We recommend the use of multicomponent nonpharmacologic interventions for the prevention of postoperative delirium in older high-risk patients	Strong	B	21		
We recommend minimization of medications known to be associated with increased risk of postoperative delirium in older high-risk surgical patients.	Strong	C	21		
Original: We recommend using processed EEG monitoring in older high-risk patients undergoing general anesthesia to reduce the risk of postoperative delirium. Updated: There is insufficient evidence to recommend using processed EEG monitoring in older high-risk surgical patients undergoing	Weak N/A	C N/A	21 16	 5	 See dissent statement

general anesthesia to reduce the risk of postoperative delirium.					
There is insufficient evidence to recommend specific anesthetic agents or doses to reduce the risk of postoperative delirium.	N/A	N/A	21		
There is insufficient evidence to recommend regional/neuraxial blockade as the primary anesthetic technique to reduce the risk of postoperative delirium.	N/A	N/A	21		
We recommend optimization of postoperative pain control to reduce the risk of postoperative delirium	Weak	C	20	1	statement should include opioid minimization (MDM)
There is insufficient evidence to recommend administration of prophylactic perioperative medications to reduce the risk of postoperative delirium	N/A	N/A	21		
We recommend using ICU protocols that include sedation with dexmedetomidine to reduce the risk of postoperative delirium in patients requiring postoperative mechanical ventilation.	Strong	B	21		

F. Supplemental Table 3. Delirium Assessment Tools Validated in Postoperative Patients

Assessment Tool	Sensitivity	Specificity
Confusion Assessment Method (CAM) ¹⁻³	43-100%	90-98%
Confusion Assessment Method for the Intensive Care Unit (CAM-ICU) ⁴⁻⁹	28-100%	89-100%
Nursing Delirium Screening Scale-98 (Nu-DESC-98) ^{2,5,7,10}	29-95%	69-90%
Neelon and Champagne (NEECHAM) Confusion Scale ¹¹⁻¹³²¹⁹⁻²²¹	87-95%	78-95%
Intensive Care Delirium Screening Checklist (ICDSC) ^{4,8,9,14}	74-99%	64-82%

Assessment Tool References

1. Inouye SK, van Dyck CH, Alessi CA, Balkin S, Siegal AP, Horwitz RI: Clarifying confusion: the confusion assessment method. A new method for detection of delirium. *Ann Intern Med* 1990; 113: 941-948
2. Radtke FM, Franck M, Schneider M, Luetz A, Seeling M, Heinz A, Wernecke KD, Spies CD: Comparison of three scores to screen for delirium in the recovery room. *Br J Anaesth* 2008; 101: 338-343
3. Smulter N, Lingehall HC, Gustafson Y, Olofsson B, Engstrom KG: Validation of the confusion assessment method in detecting postoperative delirium in cardiac surgery patients. *Am J Crit Care* 2015; 24: 480-7
4. Gusmao-Flores D, Figueira Salluh JI, Chalhub RA, Quarantini LC: The confusion assessment method for the intensive care unit (CAM-ICU) and intensive care delirium screening checklist (ICDSC) for the diagnosis of delirium: a systematic review and meta-analysis of clinical studies. *Crit Care* 2012; 16: R115
5. Neufeld KJ, Leoutsakos JS, Sieber FE, Joshi D, Wanamaker BL, Rios-Robles J, Needham DM: Evaluation of two delirium screening tools for detecting post-operative delirium in the elderly. *Br J Anaesth* 2013; 111: 7
6. Ely EW, Inouye SK, Bernard GR, Gordon S, Francis J, May L, Truman B, Speroff T, Gautam S, Margolin R, Hart RP, Dittus R: Delirium in mechanically ventilated patients: validity and reliability of the confusion assessment method for the intensive care unit (CAM-ICU). *JAMA* 2001; 286: 2703-2710
7. Luetz A, Heymann A, Radtke FM, Chenitir C, Neuhaus U, Nachtigall I, von Dossow V, Marz S, Eggers V, Heinz A, Wernecke KD, Spies CD: Different assessment tools for intensive care unit delirium: which score to use? *Crit Care Med* 2010; 38: 409-18
8. Plaschke K, von Haken R, Scholz M, Engelhardt R, Brobeil A, Martin E, Weigand MA: Comparison of the confusion assessment method for the intensive care unit (CAM-ICU) with the Intensive Care Delirium Screening Checklist (ICDSC) for delirium in critical care patients gives high agreement rate(s). *Intensive Care Med* 2008; 34: 431-6
9. Tomasi CD, Grandi C, Salluh J, Soares M, Giombelli VR, Cascaes S, Macedo RC, de Souza CL, Biff D, Ritter C, Dal PF: Comparison of CAM-ICU and ICDSC for the detection of delirium in critically ill patients focusing on relevant clinical outcomes. *J Crit Care* 2012; 27: 212-217
10. Gaudreau JD, Gagnon P, Harel F, Tremblay A, Roy MA: Fast, systematic, and continuous delirium assessment in hospitalized patients: the nursing delirium screening scale. *J Pain Symptom Manage* 2005; 29: 368-375
11. Neelon VJ, Champagne MT, Carlson JR, Funk SG: The NEECHAM Confusion Scale: construction, validation, and clinical testing. *Nurs Res* 1996; 45: 324-30

12. Matsushita T, Matsushima E, Maruyama M: Early detection of postoperative delirium and confusion in a surgical ward using the NEECHAM confusion scale. *Gen Hosp Psychiatry* 2004; 26: 158-63
13. Van Rompaey B, Schuurmans MJ, Shortridge-Baggett LM, Truijen S, Elseviers M, Bossaert L: A comparison of the CAM-ICU and the NEECHAM Confusion Scale in intensive care delirium assessment: an observational study in non-intubated patients. *Crit Care* 2008; 12: R16
14. Bergeron N, Dubois MJ, Dumont M, Dial S, Skrobik Y: Intensive Care Delirium Screening Checklist: evaluation of a new screening tool. *Intensive Care Med* 2001; 27: 859-864

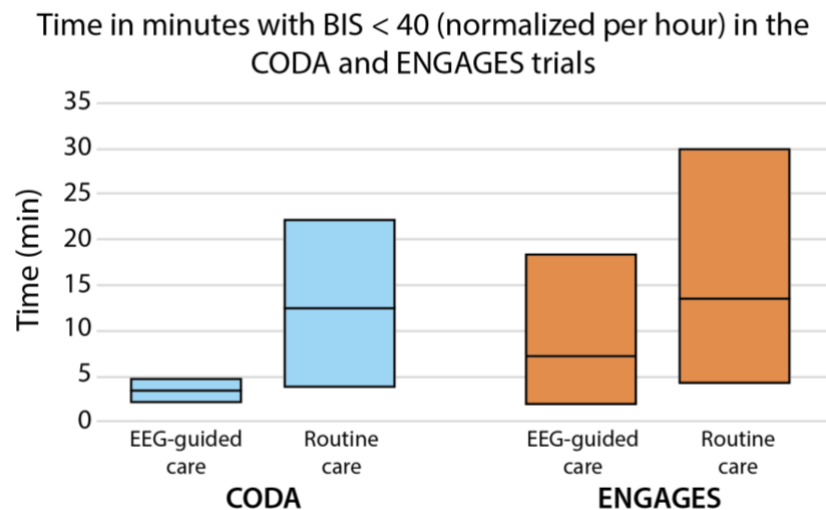
G. Dissent Statement Concerning Processed EEG

Five of the POQI-6 participants (PLP, PSG, MDM, MH, SK) believe that there is sufficient evidence to recommend the use of EEG monitors in elderly patients undergoing general anesthesia to reduce the risk of postoperative delirium.

Three large randomized trials have demonstrated a decrease of postoperative delirium with EEG-guided anesthesia (1-3), leading to the avoidance of BIS below 20, 40 and 45, respectively. In contrast, the ENGAGES trial compared a protocol focused to avoid EEG suppression with usual care, but the rate of postoperative delirium was not different between groups (4).

We dissent to the statement because the ENGAGES trial did not provide comparable evidence as for the previous trials, such as the CODA trial (2). In particular, ENGAGES failed to modify anesthetic exposure in a clinically meaningful manner. Anesthetic concentrations were reduced by 0.11 minimum alveolar concentration (MAC) in the EEG-guided group compared with usual care, a difference that is unlikely to be clinically significant. In contrast, anesthetic concentrations were reduced by 0.36 MAC in the EEG-guided group in the CODA trial (2). Patients in the ENGAGES trial tended to spend a large proportion of time with BIS < 40, even in the EEG-guided group, suggesting that EEG-guidance was inadequately performed (Figure). It would appear that ineffective EEG-guided anesthesia may contribute to the lack of reduction in postoperative delirium.

Figure. Difference in time (min) with BIS < 40 (normalized by surgical duration) in the CODA and the ENGAGES trials. The box plots indicate median and interquartile range.



There are other concerns of the ENGAGES trial. First, duration of EEG suppression and BIS < 40 were longer in patients with delirium compared with those without. Second, confusion assessment method testing was not started within 24 hours after surgery, and was only performed once daily. It should be noted that delirium typically follows a fluctuating time course (5,6). It is

therefore not surprising that postoperative delirium may have been missed with the current assessment.

Overall, we are very concerned that the tremendous benefits of intraoperative EEG guidance in elderly patients would not be valued sufficiently, especially the avoidance of burst suppression. In our opinion, EEG-guided anesthesia may be the most important technique to reduce the risk for postoperative delirium.

Dissent Statement References

1. Radtke FM, Franck M, Lendner J, Kruger S, Wernecke KD, Spies CD. Monitoring depth of anaesthesia in a randomized trial decreases the rate of postoperative delirium but not postoperative cognitive dysfunction. *Br J Anaesth*. 2013;110 Suppl 1:i98-105.
2. Chan MT, Cheng BC, Lee TM, Gin T, Group CT. BIS-guided anesthesia decreases postoperative delirium and cognitive decline. *J Neurosurg Anesthesiol*. 2013;25(1):33-42.
3. Whitlock EL, Torres BA, Lin N, Helsten DL, Nadelson MR, Mashour GA, et al. Postoperative delirium in a substudy of cardiothoracic surgical patients in the BAG-RECALL clinical trial. *Anesth Analg*. 2014;118(4):809-17.
4. Wildes TS, Mickle AM, Ben Abdallah A, Maybrier HR, Oberhaus J, Budelier TP, et al. Effect of Electroencephalography-Guided Anesthetic Administration on Postoperative Delirium Among Older Adults Undergoing Major Surgery: The ENGAGES Randomized Clinical Trial. *JAMA*. 2019;321(5):473-83.
5. Monk TG, Saini V, Weldon BC, Sigl JC. Anesthetic management and one-year mortality after noncardiac surgery. *Anesth Analg*. 2005;100(1):4-10.
6. Lindholm ML, Traff S, Granath F, Greenwald SD, Ekbom A, Lennmarken C, et al. Mortality within 2 years after surgery in relation to low intraoperative bispectral index values and preexisting malignant disease. *Anesth Analg*. 2009;108(2):508-12.
7. Leslie K, Myles PS, Chan MT, Forbes A, Paech MJ, Peyton P, et al. Nitrous oxide and long-term morbidity and mortality in the ENIGMA trial. *Anesth Analg*. 2011;112(2):387-93.
8. Schultz B, Schultz A, Grouven U, Zander I, Pichlmayr I. [Changes with age in EEG during anesthesia]. *Anaesthesist*. 1995;44(7):467-72.
9. Purdon PL, Pavone KJ, Akeju O, Smith AC, Sampson AL, Lee J, et al. The Ageing Brain: Age-dependent changes in the electroencephalogram during propofol and sevoflurane general anaesthesia. *Br J Anaesth*. 2015;115 Suppl 1:i46-i57.
10. Muhlhofer WG, Zak R, Kamal T, Rizvi B, Sands LP, Yuan M, et al. Burst-suppression ratio underestimates absolute duration of electroencephalogram suppression compared with visual analysis of intraoperative electroencephalogram. *Br J Anaesth*. 2017;118(5):755-61.
11. Aldecoa C, Bettelli G, Bilotta F, Sanders RD, Audisio R, Borozdina A, et al. European Society of Anaesthesiology evidence-based and consensus-based guideline on postoperative delirium. *Eur J Anaesthesiol*. 2017;34(4):192-214.
12. Hesse S, Kreuzer M, Hight D, Gaskell A, Devari P, Singh D, et al. Association of electroencephalogram trajectories during emergence from anaesthesia with delirium in the postanesthesia care unit: an early sign of postoperative complications. *Br J Anaesth*. 2019;122(5):622-34.